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EXAMINER	
CULBERT, ROBERTS P	

ART UNIT	PAPER NUMBER
1763	6

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/061,492	BUSWELL ET AL.	
	Examiner	Art Unit	
	Roberts Culbert	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 June 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-45* is/are pending in the application.

4a) Of the above claim(s) *12,23,32,40,42,44 and 45* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11,13-22,24-31,33-39,41 and 43* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/3/02*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-11, 13-22, 24-31, 33-39, 41 and 43, drawn to a method of forming a slot in a semiconductor substrate, classified in class 216, subclass 27.

II. Claims 12, 23, 32, 40, 42, and 44, drawn to a fluid ejecting device, classified in class 347, subclass 20.

III. Claim 45, drawn to a computer application, classified in class 700, subclass 95.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process such as forming the slot through the semiconductor substrate from one side only.

Inventions III and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process such as performing the removal process manually without a computer.

Inventions I and III are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct from each other if they are shown to be separately usable. In the instant case, invention I has separate utility such as forming a slot manually. Invention III has separate utility such as forming slots in a non-semiconductor substrate. See MPEP § 806.05(d).

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification and recognized divergent subject matter, and the search required for one group is not required for the other groups, restriction for examination purposes as indicated is proper.

During a telephone conversation with Paul W. Mitchell on 12/8/03 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-11, 13-22, 24-31, 33-39, 41 and 43. Affirmation of this election must be made by applicant in replying to this Office action. Claims 12, 23, 32, 40, 42, 44 and 45 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the

examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 24, 25, 41, and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,271,102 to Brouillette et al.

Brouillette teaches a method of forming a slot in a semiconductor substrate containing microelectronics (Col. 5, Line 7) comprising making a cut into a first surface of a semiconductor substrate, and removing material from a second surface of the substrate to form in combination with the cut, a slot at least a portion of which passes entirely through the substrate. (Col. 5, Lines 52-67 and Col. 6, Lines 1-30) Brouillette teaches forming the slot using a saw blade (Col. 5, Line 54- Col. 6, Line 4)

Brouillette does not explicitly teach that the saw blade is a circular cutting disk revolving around an axis generally parallel to the first and second surfaces. (I.e. not perpendicular to the first surface)

However, Official Notice is taken of the fact that it is well known in the art of cutting slots using a saw blade that a saw blade is typically a circular cutting disk revolving around an axis generally parallel to the surface to be cut.

Furthermore, Brouillette teaches forming the slot using a saw blade and shows that a dicing (saw) blade is used (Figures 6A and 6B). It may be assumed that the dicing blade is a saw blade that is circular with an axis generally parallel to the first and second surfaces as shown in Figure 1.

Regarding Claim 25, the removing from a first side and removing from a second side comprise cutting the substrate with the cutting tool.

Claims 1- 8, 10, 11, 13- 19, 22, 24, 25, 31, 41 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,746,935 to Allen in view of U.S. Patent 6,271,102 to Brouillette et al.

Allen teaches a method for forming a fluid feed (handling) slot in a print-head semiconductor substrate containing microelectronics (34, 36, and 38) comprising forming a slot through the substrate using a diamond saw blade or laser drilling. (Col. 3, Lines 45-48)

Allen does not teach forming the slot by making a cut into a first surface and removing material from the second surface to form the slot.

Referring to Figures 4A-4C, Brouillette teaches a method of forming a slot in a semiconductor substrate comprising making a cut into a first surface of a semiconductor substrate, and removing material from a second surface of the substrate to form in combination with the cut, a slot at least a portion of which passes entirely through the substrate. See (Col. 5, Lines 52-67 and Col. 6, Lines 1-30).

It would have been obvious to one of ordinary skill in the art at the time of invention to form the fluid handling slot of Allen using the two sided technique described by Brouillette.

One of ordinary skill in the art would have been motivated at the time of invention to form the fluid handling slot of Allen using the two sided technique described by Brouillette in order to improve quality of the cut and reduce substrate cracking as well as other advantages listed by Brouillette. See (Col. 6, Lines 14-30).

Regarding Claims 1, 24, 41, and 43, Brouillette does not explicitly teach that the saw blade is a circular cutting disk having a generally planar surface revolving around an axis generally parallel to the first and second surfaces. (I.e. not perpendicular to the first surface)

Official Notice is taken of the fact that it is well known in the art of cutting slots using a saw blade that a saw blade is typically a circular cutting disk having a generally planar surface revolving around an axis generally parallel to the surface to be cut.

Furthermore, Allen teaches using a diamond saw blade to form the fluid-handling slot. Brouillette also teaches forming the slot using a saw blade and shows that a dicing (saw) blade is used (Figures 1, 6A and 6B). It may be assumed that the dicing blade is a saw blade that is circular having a generally planar surface with an axis generally parallel to the first and second surfaces as shown in Figure 1, 6A and 6B.

Regarding Claim 2, Allen teaches that the substrate having the slot formed therein comprises a thin film composite. (Col. 4, Lines 13-22) Brouillette also teaches forming the slot so that the step of

removing comprises removing thin film material (34) from the first surface. See Figures 4A-4C and (Col. 5, Line 7) for example. In either case, the step of making a cut into the first surface comprises making a cut into a thin film side of the substrate.

Furthermore, it would have been obvious to one of ordinary skill in the art at the time of invention to form the semiconductor slot of Allen so that the step of removing comprises removing thin film material from the first surface.

One of ordinary skill in the art would have been motivated at the time of invention to form the fluid handling slot of Allen so that the step of removing comprises removing thin film material from the first surface in order to form a feed slot through a substrate having all the necessary layers to function as an ink jet printhead. See (Col. 4 lines 13-39) of Allen.

Regarding Claim 4, the step of making a cut into the first surface comprises making a cut into a backside of the substrate. See Figures 4A and 4B.

Regarding Claim 5, the step of making a cut with a disk comprises making a cut with a circular saw. See (Col. 3, Lines 45-49) of Allen and (Figures 1, 6A, and 6B) of Brouillette.

Regarding Claim 6, the step of making a cut into the first surface comprises making a cut at least a portion of which extends through the substrate.

Regarding Claim 8, the step of removing comprises making a second cut with a disk.

Regarding Claim 10, the steps of removing and cutting form a slot having end walls, and where the step of removing forms a first portion of the end walls and the step of cutting forms a second portion of the end walls and wherein the first and second portions of each of the end walls meet at angle greater than or equal to ninety degrees relative to the substrate. See Figures 4A-4C and 7A-7C of Brouillette.

Regarding Claim 11, the act of removing is performed before the act of making a cut.

Regarding Claim 14, the step of creating comprises cutting with a circular saw. See (Col. 3, Lines 45-49) of Allen and (Figures 1, 6A, and 6B) of Brouillette.

Regarding Claims 3, and 15-17, Figure 1 and Col. 1, Lines 16-25 of Brouillette teaches that it is known to form a sawing cut by moving the circular saw in a direction parallel (x-direction) to the first surface to define the length of the slot. It is clear from the illustration that first the saw blade must enter from a direction perpendicular (y-direction) to the first surface in order to enable placement of the slot in a desired location on the substrate surface.

Furthermore, Official Notice is taken of the fact that it is old and well known in the art of sawing slots in a planar substrate to move the saw first in a direction perpendicular to the surface to define the placement of the slot and then parallel to the surface to define the length of the slot.

Regarding Claims 7, and 18, Official Notice is taken of the fact that it is old and well known in the art of cutting wit a circular saw to make multiple passes with a saw blade to increasing depth in order to prevent cracking of the substrate. It would have been obvious to one of ordinary skill in the art at the time of invention to make multiple passes with a saw blade to increasing depth in order to prevent cracking of the substrate in the well known manner.

Regarding Claim 19, the act of cutting occurs prior to the act of creating.

Regarding Claim 22, Official Notice is taken of the fact that it is old and well known in the art of forming slots in a workpiece that either a saw or a rotary drill such as a router is suitable for the task.

It would have been obvious to one of ordinary skill in the art at the time of invention to form the semiconductor slot using a rotary drill such as a router in place of the saw in the method of Brouillette as a matter of substituting equivalents known for the same purpose. See MPEP 2144.06.

Regarding Claim 25, the removing from a first side and removing from a second side comprise cutting the substrate with the cutting tool.

Regarding Claim 31, Brouillette teaches that other methods of cutting such as laser cutting (machining) are suitable for forming slots in a silicon substrate. See (Col. 5, Lines 55-56 and Col. 5, Line 65-Col. 6, Line 7). Allen further teaches that sawing and laser drilling are art recognized equivalents for the purpose of forming ink feed slots in a silicon substrate. (Col. 3, Lines 45-48)

It would have been obvious to one of ordinary skill in the art at the time of invention to form the slots using either laser drilling (machining) or sawing with a blade as taught by Allen as a matter of substituting equivalents known for the same purpose. See MPEP 2144.06.

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,746,935 to Allen in view of U.S. Patent 6,271,102 to Brouillette et al. and in further view of U.S. Patent 6,238,269 to Pollard et al.

As applied above, Allen in view of Brouillette teaches the method of the invention substantially as claimed, but does not teach the use of sand drilling to form the slots in the semiconductor substrate.

Pollard teaches that it is known in the art of forming ink feed slots in an printhead substrate to use abrasive jet machining otherwise known as drilling or sand blasting (sand drilling) to form the slot in the substrate. (Col. 1, Line 62- Col. 2, Line 4)

It would have been obvious to one of ordinary skill in the art at the time of invention to form the slots using either sand drilling as taught by Pollard or sawing with a blade or laser machining as taught by Allen as a matter of substituting equivalents known for the same purpose. See MPEP 2144.06.

Note that Brouillette teaches that other methods of cutting besides sawing are suitable for forming the silicon substrate slots. (Col. 5, Lines 55-56 and Col. 5, Line 65-Col. 6, Line 7)

Claims 9, 20 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,746,935 to Allen in view of U.S. Patent 6,271,102 to Brouillette et al. and in further view of U.S. Patent 5,658,471 to Murthy et al.

As applied above, Allen in view of Brouillette teaches the method of the invention substantially as claimed, but does not teach the use of etching including wet etching to form the slots in the semiconductor substrate.

Murthy teaches that an ink-jet feed slot may be partially formed in a silicon substrate by anisotropic etching with any known anisotropic etchant. (Col. 6, Lines 29-32) and (Col. 6, Lines 50-51) Murthy teaches that potassium hydroxide (a wet etchant) is preferred for the etching process. (Col. 6, Lines 54-55)

It would have been obvious to one of ordinary skill in the art at the time of invention to partially form the semiconductor slot using a wet etchant such as potassium hydroxide as taught by Murthy.

Since Murthy teaches that anisotropic wet etching is a suitable method for forming a slot partially through a silicon printhead substrate to form an ink-jet feed slot, one of ordinary skill in the art would have been motivated at the time of invention to form the feed slot of Allen in view of Brouillette using wet etching as a matter of substituting equivalents known for the same purpose. See MPEP 2144.06.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,746,935 to Allen in view of U.S. Patent 6,271,102 to Brouillette et al. and U.S. Patent 5,658,471 to Murthy et al. as applied above, and in further view of the publication "*Silicon processing for the VLSI era*" to Wolf et al.

As applied above, Allen in view of Brouillette and Murthy teaches the method of the invention substantially as claimed, but does not teach the use of dry etching to form the slots in the semiconductor substrate.

Although Murthy teaches that an ink-jet feed slot may be partially formed in a silicon substrate by anisotropic etching with any known anisotropic etchant (Col. 6, Lines 50-51), Murthy does not specifically suggest dry etching for the anisotropic etch.

Wolf teaches that dry etching is a suitable method for forming an anisotropic etch in a silicon substrate. See page 539.

It would have been obvious to one of ordinary skill in the art at the time of invention to partially form the semiconductor slot as shown by Murthy using a dry etching technique as taught by Murthy in order to form a highly anisotropic etch and avoid the handling of large amounts of hazardous solvents as taught by Wolf.

Claims 27- 29 and 33- 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,746,935 to Allen in view of U.S. Patent 6,271,102 to Brouillette et al. and in further view of U.S. Patent 4,887,100 to Michaelis et al.

As applied above, Allen in view of Brouillette teaches the method of the invention substantially as claimed, but does not teach that the slot has an aspect ratio greater than or equal to one

However Michaelis teaches that it is known in the art of cutting slots (ink channels) in a printhead, to form the slots with an aspect ratio grater than 1, typically 3 to 30. See (Col. 4, Lines 23-33).

It would have been obvious to one of ordinary skill in the art at the time of invention to form the semiconductor slot of Allen using the two sided technique described by Brouillette.

One of ordinary skill in the art would have been motivated at the time of invention to form the fluid handling slot of Allen using the two sided technique described by Brouillette in order to improve quality of the cut and reduce substrate cracking as well as other advantages listed by Brouillette. See (Col. 6, Lines 14-30).

Regarding Claims 34 and 35, Brouillette teaches the limitations as claimed because either cutting step of Brouillette reads on either the removing step or the mechanical cut of the claimed invention.

Regarding Claim 36, the removing step of Brouillette comprises one of dry etching, wet etching cutting or laser ablating the substrate.

Regarding Claim 37, Allen teaches that the substrate having the slot formed therein comprises a thin film composite. (Col. 4, Lines 13-22) Brouillette also teaches forming the slot so that the step of removing comprises removing thin film material (34) from the first surface. See Figures 4A-4C and (Col.

5, Line 7) for example. In either case, the step of removing comprises removing thin film material from the first surface.

Furthermore, it would have been obvious to one of ordinary skill in the art at the time of invention to form the semiconductor slot of Allen so that the step of removing comprises removing thin film material from the first surface.

One of ordinary skill in the art would have been motivated at the time of invention to form the fluid handling slot of Allen so that the step of removing comprises removing thin film material from the first surface in order to form a feed slot through a substrate having all the necessary layers to function as an ink jet printhead. See (Col. 4 lines 13-39) of Allen.

Claims 38 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,746,935 to Allen in view of U.S. Patent 6,271,102 to Brouillette et al. and U.S. Patent 4,887,100 to Michaelis et al. and in further view of U.S. Patent 6,238,269 to Pollard et al.

As applied above, Allen in view of Brouillette and Michaelis teaches the method of the invention substantially as claimed, but does not teach the use of sand drilling to form the slots in the semiconductor substrate.

Pollard teaches that it is known in the art of forming ink feed slots in an printhead substrate to use abrasive jet machining otherwise known as drilling or sand blasting (sand drilling) to form the slot in the substrate. (Col. 1, Line 62- Col. 2, Line 4)

It would have been obvious to one of ordinary skill in the art at the time of invention to form the slots using either sand drilling as taught by Pollard or sawing with a blade or laser machining as taught by Allen as a matter of substituting equivalents known for the same purpose. See MPEP 2144.06.

Note that Brouillette teaches that other methods of cutting besides sawing are suitable for forming the silicon substrate slots. (Col. 5, Lines 55-56 and Col. 5, Line 65-Col. 6, Line 7)

Regarding Claim 39, provided that sand drilling is substituted for cutting as applied above, the step of sand drilling occurs prior to making the mechanical cut.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent 5,998,234 to Murata teaches forming a slot in a semiconductor substrate by etching from one side and then sawing from the other side with a dicing blade to form a slot with reduced cracks and chippings.

U.S. Patent 5,387,314 to Baughman et al. teaches forming an ink fill slot in a printhead substrate using a two-sided etching process.

U.S. Patent 5,408,739 to Altavela et al. teaches forming a slot in a semiconductor substrate using a two-sided dicing process to reduce chips and cracks in the substrate.

U.S. Patent 6,345,885 to Lin et al. teaches forming ink feed slots using sand drilling.

U.S. Patent 6,117,347 to Ishida teaches a method for forming a slot in a semiconductor substrate using either dry etching laser or sand blasting from one side and sawing from the other side.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberts Culbert whose telephone number is (571) 272-1433. The examiner can normally be reached on Monday-Friday (7:30-4:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (571) 272-1439. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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